



ENVIRONMENTAL TECHNOLOGY VERIFICATION SHOWCASE *Inside*

Taking the Lead in Verification

Why Verify Innovative Environmental Technologies?

Innovative technologies are necessary to close the gap between our environmental goals and our ability to meet them. Numerous environmental problems remain unsolved while the cost of environmental protection remains high for small communities and businesses. In addition, innovative technologies assist one of America's major industries – environmental technology – to grow and take advantage of U.S. and foreign markets. Unfortunately, innovation has moved slowly due to regulatory and institutional barriers that tend to “lock in” existing technologies and thereby increase the risk of using newer technologies. For example, consultants and regulators tend to be averse to taking risks because of legal and financial vulnerability if a new technology does not work as claimed. Both of these factors are due, in part, to a lack of credible information on technology performance.

Technology verification can help companies overcome these barriers by:

- Providing objective, credible performance data to buyers;
- Facilitating permitting at state and local levels;
- Reducing the risk for financial investors;
- Providing a level playing field among competitors; and
- Facilitating export of American products.

Over the past several years, government has responded to these problems by establishing programs designed to verify technology performance. One of



The Environmental Technology Verification (ETV) Program is carried out through a wide variety of partnerships. The efforts of each of the partners are guided by the expertise of a stakeholder group. Pictured here is Penny Hansen, ETV Program Coordinator, at a pilot stakeholder meeting.

the earliest federal programs is EPA's Superfund Innovative Technology Evaluation (SITE) Program. More recently, EPA created the Environmental Technology Verification (ETV) Program. Other federal agencies such as the Department of Defense and the Department of Energy have also established verification programs to facilitate cleanup of their sites. On the state level, verification programs have been established in Massachusetts, California, New Jersey and Washington.

This edition of *TECHNOVATION* features an overview of EPA's Environmental Technology Program and showcases ETV-verified technologies from New England-based companies. It also provides information on two regional programs - the Northeast Waste Management Officials' Association

(NEWMOA) Technology Review Committee and the Massachusetts Strategic Environmental Partnership (STEP). Further information on some of the other verification programs mentioned can be found on the EPA New England's Center for Environmental Industry and Technology web site (<http://www.epa.gov/region01/steward/ccit>).

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Environmental Technology Verification Program

The Environmental Protection Agency (EPA) has instituted the Environmental Technology Verification Program (ETV) under the management of the Office of Research and Development. The goal of ETV is to verify the performance characteristics of commercial-ready environmental technologies through the evaluation of objective and quality-assured data. For many years,

Through ETV, technology buyers and developers, consulting engineers, states, EPA Regions, financiers, and the international community are supplied with high quality, objective data through an independent and credible assessment of the performance of new technologies.

EPA has evaluated environmental technologies through the Superfund Innovative Technology Evaluation (SITE) Program to determine their effectiveness in preventing, controlling, cleaning up, and monitoring pollution. ETV expands and systematizes these efforts through verification of technical solutions to problems threatening human health and the environment across all media and environmental programs. Through ETV, technology buyers and developers, consulting engineers, states, EPA Regions, financiers, and the international community are supplied with high quality, objective data through an independent and credible assessment of the performance of new technologies.

ETV utilizes the expertise of partner “verification organizations” to design and execute efficient processes for conducting performance tests of innovative technologies. These partners,

from both the public and private sectors, oversee and report verification activities based on testing and quality assurance protocols developed with input from all major stakeholder groups associated with the technology area. Following verification testing, EPA issues the Verification Statement outlining the major performance characteristics of the technology and the Verification Report containing details of the testing method and procedures, and the results.

EPA has established 12 ETV technology verification pilot programs covering a broad range of environmental areas which include:

- Drinking Water Systems
- Site Characterization and Monitoring Technologies
- Pollution Prevention, Recycling and Waste Treatment Systems
- Pollution Prevention through Improved Coatings and Coating Equipment
- Indoor Air Products
- The EvTEC Program, an independent pilot operated by the Civil Engineering Research Foundation
- Source Water Protection
- Greenhouse Gas Technology
- Pollution Prevention in the Metal Finishing Industry
- Advanced Monitoring Systems
- Air Pollution Prevention and Control Technologies
- Wet Weather Flow

To date, ETV has verified the performance of 66 environmental technologies. Approximately 98 others are now in process and 202 applications for verification are pending. While verification costs will vary with the technologies to be tested, the tests conducted early in the pilot program may be partially funded by the government through its verification partners. In depth information about all of the pilots, including the names and affiliations of stakeholder group members,

protocols, and generic test plans, is available on the ETV web site at <http://www.epa.gov/etv>.

The ETVoice is a list server that provides subscribers with up-to-date communication of critical information and key highlights of the ETV program. If you are interested in subscribing to ETVoice, you may do so at the ETV Web Site. If you do not have Internet access, you may send an e-mail message to:

listserv@unixmail.rtpnc.epa.gov. Leave the subject line empty and in the body of the message type “subscribe ETVoice First name Last name.” Send the e-mail with no further text in the body of the message.

See the back cover for a list of ETV Program Pilot Managers.

For more information:

Sarah Bauer
ETV Outreach Coordinator
EPA Headquarters
Mail Code 8301D
Ariel Rios Building
1200 Pennsylvania Avenue NW
Washington, D.C. 20460
202-564-3267

New England Interstate ETV Outreach Program

While the goal of the Environmental Technology Verification (ETV) Program is to verify performance characteristics of commercial-ready technology, the Environmental Protection Agency (EPA) recognizes that verification in itself will not move better, cheaper, faster technologies into the marketplace. Significant barriers still exist as a result of the lack of information and regulatory acceptance of verified data by state and local regulators. Similar barriers also impact private sector users of technology such as the consulting engineering community.

In an effort to overcome these barriers, EPA, EPA-New England's Center for Environmental Industry and Technology (EPA-NE/CEIT), and the six New England states, through the New England Governors' Conference, Inc. (NEGCI), are cooperating in a New England ETV Outreach Program. The objective of the program is to develop appropriate marketing strategies for selected ETV pilot programs to facilitate acceptance of the

verified data within the region. Because these pilots are in various stages of activity, the program takes a two-pronged approach. For the earlier funded pilots, the focus of the work will be to help recruit vendors for participation and dis-

seminate verification results to facilitate region-wide acceptance. For the later funded pilots, the focus will be on identifying their marketing needs for New England as well as recruit vendors and disseminate results.

The New England ETV Outreach Program is designed to:

- Ensure that information and data generated by the ETV pilots serve the needs of state and local permittees; and
- Develop strategies for getting the information directly to these permittees and industry users in ways that will increase their comfort level in more readily accepting verified data.

Through this outreach program, the New England states will be assured to have their technology needs met by ETV pilots in both developing protocols

and organizing/conducting technology demonstrations. This program will provide an opportunity for New England-based technology companies to get their products verified early resulting in less cost to them as well as earlier market penetration.

The objective of the program is to develop appropriate marketing strategies for selected ETV pilot programs to facilitate acceptance of the verified data within the region.

For more information:

Carol Kilbride
U.S. EPA Region 1
1 Congress Street
Suite 1100 (SPI)
Boston, MA 02114
1-800-575-2348 or
617-918-1783
kilbride.carol@epa.gov

OR

For more information:

John Shea
New England Governors'
Conference Inc.
76 Summer Street
Boston, MA 02110-1226
617-423-6900
617-423-7327 (FAX)
negc@tiac.net



Amy Dindal, Technical Director, inspects one of more than 2300 prepared samples. (Photo taken at technology demonstration of PCB field analytical techniques conducted at Oak Ridge National Laboratory)

NITON XL Spectrum Analyzer

"NITON is a strong proponent of the ETV program," says Dr. Donald Sackett, Vice President of Sales and Marketing for NITON Corporation. "A mechanism for EPA to rapidly assess and publish performance characteristics of new technologies has been long overdue and is desperately needed to stimulate private sector research into innovative technologies. The ETV program is to be commended for fulfilling this need."

According to Sackett, the single most powerful benefit provided by the ETV program was the performance analysis. He states, "Because this data is generated by EPA and an EPA-sanctioned contractor, it is viewed as highly credible." He reports that the performance data has been key to NITON's sales of instrumentation to EPA field offices, state environmental agencies and consulting firms with large site assessment or remediation contracts. He estimates that about \$500,000 in sales would have been delayed or lost completely had NITON not been able to participate in the ETV program. 'Ripple effect' sales from referrals and successes from the above sales would also not have occurred.

ETV demonstration of the NITON XL Spectrum Analyzer was conducted in

April 1995. Two sites were used for this demonstration: RV Hopkins and the ASARCO Tacoma Smelter. RV Hopkins is an active steel drum recycling facility and the site of a former battery recycling operation located in Davenport, Iowa. The ASARCO site is a former copper and lead smelter located in Tacoma, Washington. The samples analyzed during this demonstration, were evenly distributed between three distinct soil textures: sand, loam and clay. In addition, four sample preparation steps were evaluated.



NITON XL Spectrum Analyzer

NITON XL Spectrum Analyzer is a hand-held instrument weighing less than three pounds which can be battery-powered up to eight hours. It can be equipped with up to three different radioisotopes depending on what elements are required for analysis. It uses a high-resolution PIN diode detector (<300 eV FWHM at 5.95 keV) for the analysis of metals in soil using relatively short count times (60 seconds). The XL Spectrum Analyzer can conduct in situ measurements or measure prepared samples in cups. The cost of the analyzer ranges between \$14,000 and \$50,000 depending on the number of applications and number of radioisotopes. It can also be leased or rented starting at

\$2,500 per month or \$1,000 week.

The NITON XL Spectrum Analyzer was originally designed to produce quantitative data for lead in painted surfaces. The demonstration found that it could also provide quantitative data for metals contamination in soil. The demonstration also found that the analyzer was generally simple to operate in the field and that the operator required no specialized experience or training. However, ownership and operation of the analyzer may require specific licensing by state nuclear regulatory agencies.

The Verification Statement reports that the NITON XL Spectrum Analyzer is an effective tool for field use and can provide rapid, real-time analysis of the metals content of soil samples at hazardous waste sites. The analyzer can quickly identify contaminated areas allowing investigation or remediation decisions to be made more efficiently on-site, and thus reduce the number of samples that need to be submitted for confirmatory analysis.

For more information:

Don Sackett
NITON Corporation
90 Middlesex Turnpike,
Building 8
Billerica, MA 01821
978-670-7460
1-800-875-1578
email: sales@niton.com

Notice: EPA verifications are based on an evaluation of technology performance under specific, predetermined criteria and the appropriate quality assurance procedures. EPA makes no expressed or implied warranties as to the performance of the technology and does not certify that a technology will always, under circumstances other than those tested, operate at the levels verified. The end user is solely responsible for complying with any and all applicable Federal, State, and Local requirements.

Dexsil L2000 PCB/Chloride Analyzer

The Dexsil L2000 PCB/Chloride Analyzer is a field-portable instrument designed to quantify polychlorinated biphenyl (PCB) concentration in soils, dielectric fluids, and surface wipes. Its dimensions are 8"x8"x4.5" and it weighs approximately 3.5 lbs. The L2000 utilizes a chloride-specific electrode to determine the amount of chlorine in a sample after the sample has been digested to convert the bound chlorine into ionic chloride. The L2000 detects the total chloride content of the sample and then electronically converts total chloride content to PCB concentration in units of parts per million (ppm). The L2000 provides no information on Aroclor identification.

In July 1997, the performance of the L2000 PCB/Chloride Analyzer was determined under field conditions. The demonstration was designed to detect and measure PCBs in soil and solvent extracts. The study was conducted outdoors and in a controlled environmental chamber. Multiple soil types, collected from sites in Ohio, Kentucky and Tennessee, were analyzed in this study. Solutions of PCBs were also analyzed to simulated extracted surface wipe samples.

The demonstration found that the L2000 was simple to operate in the field and required minimal training to operate. The overall performance was characterized as consistently biased but precise. After correction for bias, the resulting L2000 method detection limit agrees with Dexsil's specified method detection limit of two ppm. The Verification Statement states that the results of the demonstration show that the L2000 PCB/Chloride Analyzer can provide useful cost-effective data for environmental problem-solving and decision making. Undoubtedly, it will be employed in a variety of applications, ranging from serving as a complement to data generated in a fixed analytical laboratory to generating data that will stand alone



Dexsil team completes their last set of soil samples and begins analyzing the surface wipe extracts. (Photo taken at technology demonstration of PCB field analytical techniques conducted at Oak Ridge National Laboratory).

in the decision making process.

According to Jack Mahon of Dexsil Corporation, ETV gave his company the opportunity to evaluate and compare its new product with the competition's in a supervised environment and with impartial referees. "We found this to be a very efficient way to have our technology looked at by EPA, our competition, and our potential customers," says Mahon. "ETV confirmed our own studies as to the effectiveness of our product for the marketplace."

Dexsil Corporation has recently announced the introduction of the L2000 DX, an improved model of the L2000 PCB/Chloride Analyzer. The new L2000 DX is all digital with stored methods to analyze for most PCB Aroclors, chlorinated compounds such as chlorinated organic solvents, pesticides, and herbicides in four different matrixes. The new features incorporated in the L2000 DX are:

- All digital
- Battery-powered for field use
- 40 character thermal printer
- 110 volt or 220 volt line power charger
- Custom programming
- Backlit 2x16 LCD Display
- 28 programmed methods for chlorinated compounds
- Use in four matrixes: water, soil, transformer oil, surface wipes

For more information:

Jack Mahon
Dexsil Corporation
One Hamden Park Drive
Hamden, CT 06517
203-288-3509

EnviroLogix PCB in Soil Tube Assay

EnviroLogix found the ETV program to be very well organized. "Clear information on every step leading up to the actual running of the samples at Oak Ridge was easily available," says Jonathan Matt of EnviroLogix. "The organization and interpretation of the final data were clearly explained." Jonathan also remarked that the company could not afford to produce the amount of gas chromatograph correlation data provided by the ETV program on its own. The company sends potential customers to ETV's web site as a quick, painless way for the customers to compare EnviroLogix's products with the competition's without any bias.

EnviroLogix's PCB in Soil Tube Assay is an immunoassay kit used to determine PCB concentrations as interval results. The test kit uses competitive binding enzyme immunoassay to perform rapid testing for PCBs in soils and solutions at specified threshold values of 1, 10 and 50 ppm. The test kit is standardized using Aroclor 1254.

The presence of PCBs is detected by a photometer based on a colored reaction in which the color development is inversely proportional to the concentration of PCB in the sample (e.g., the darker the color, the less analyte PCB is present in the sample). The kit provides no information on Aroclor identification.

In September 1998, EnviroLogix's PCB in Soil Tube Assay was evaluated. The demonstration was designed to detect and measure polychlorinated biphe-



Jonathan Matt of EnviroLogix begins analyzing his first set of PCB-contaminated soil samples. (Photo taken at technology demonstration of PCB field analytical techniques conducted at Oak Ridge National Laboratory.)

nyls (PCBs) in soil and solvent extracts. The study was conducted under two environmental conditions. The first site was outdoors, with naturally fluctuating temperatures and relative humidity conditions. The second site was inside a controlled environmental chamber, with generally cooler temperatures and lower relative humidities. Multiple soil types, collected from sites in Ohio, Kentucky and Tennessee, were analyzed in this

study. Solutions of PCBs were also analyzed to simulate extracted surface wipe samples.

The demonstration found that the PCB in Soil Tube Assay was simple to operate in the field, requiring about an hour for initial setup and preparation for sample analysis. The performance of the test kit was characterized as unbiased, because most of the PCB in Soil Tube Assay results agreed with the certified PE values, but imprecise, because nearly half

of the PE replicate results were not reported as the same interval. It should be noted that almost all of the imprecision occurred when the concentration of the sample was near one of the test kit's threshold values (i.e., 1, 10 or 50 ppm). The test kit had no false positive results (i.e., a result in which the technology detects PCBs in the sample above the detection limit when there actually are no PCBs present), and 4% of the soil sample results were false negatives (i.e., the technology indicates that there are no PCBs present in the sample, when there actually are). For extract samples, the test kit had no false positive or false negative results.

The ETV report states that the results of the demonstration show that the PCB in Soil Assay can provide useful cost-effective data for environmental problem-solving and decision making. Undoubtedly, it will be employed in a variety of applications, ranging from serving as a complement to data generated in a fixed analytical laboratory to generating data that will stand alone in the decision making process.

For more information:

Jonathan Matt
EnviroLogix, Inc.
55 Industrial Way
Portland, ME 04103
207-797-0300

Strategic Diagnostic Inc. Immunoassay Test Systems

In July 1997, ETV testing was performed on three of Strategic Diagnostic, Inc.'s (SDI) polychlorinated biphenyl (PCB) field analytical test kits: D TECH, EnviroGard and RaPID Assay System. The demonstration was designed to detect and measure PCBs in soil and solvent extracts. The study was conducted under outdoor and in a controlled environmental chamber. Multiple soil types, collected from sites in Ohio, Kentucky, and Tennessee, were analyzed in this study. Solutions of PCBs were also analyzed to simulated extracted surface wipe samples.

According to Tim Lawruk of Strategic Diagnostic, Inc. the benefits of the ETV Program in the technology area include:

- Direct controlled comparison of innovative technology with established, approved methods (i.e., immunoassay vs. lab methods);
- Comparison of technology performance vs. the competition's so that customers can make well-informed decisions; and,
- aid in fulfilling the requirement of Performance Based Method Selection (PBMS).

"A customer can make well-informed decisions on the appropriate innovative technology," says Lawruk. "Our web sites link to the Verification Documents which serve as marketing literature, i.e., case studies." He also noted regulatory benefits of the program including EPA/DOE position in promoting innovative technology to the entire regulatory community.

D TECH PCB Test Kit

The D TECH PCB test kit is designed to provide quick, semi-quantitative test results for making environmental decisions. The D TECH kit utilizes immu-

noassay technology to detect trace amounts of PCBs in environmental samples. This test specifically:

- Detects Aroclors 1254, 1260, and 1262 equally;
- Reacts well with Aroclors 1242, 1248 and 1268;
- Reacts moderately with Aroclors 1232 and 1016; and,
- Shows little reactivity to Aroclor 1221.

The test is calibrated for Aroclor 1254

and has conversions for Aroclors 1242 and 1248. The D TECH PCB test kit uses latex particles as the solid support component of the assay. With this immunoassay system, antibodies are immobilized on the thousands of latex particles that

are free to interact and react with the

sample solution. An added enzyme conjugate produces a color change reaction that can be detected and measured. The darker the color, the less analyte PCB is present in the sample. Measurement of the test result can be completed instrumentally with a reflectance meter or visually with the included color card. The D TECH kit provides no information on Aroclor identification.

The demonstration found that the D TECH kit was simple to operate in the field, requiring about an hour for initial setup and preparation for sample analysis. The overall performance of the D TECH PCB test kit was characterized as biased, with approximately 50% of the D TECH results agreeing with the accepted values, and imprecise, with less than 50% replicate sample results.

EnviroGard PCB Test Kit

The EnviroGard PCB test kit is an

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SDI team analyzes PCB-contaminated soil samples using their Rapid-Assay System for PCB Analyses. The environmental chamber is being used to simulate weather conditions at a site that has 25% relative humidity and a temperature of 55° F. (Photo taken at technology demonstration of PCB field analytical techniques conducted at Oak Ridge National Laboratory)

Strategic Diagnostic Inc. Immunoassay Test Systems, *Continued from page 7*

immunoassay kit used to determine PCB concentrations as interval threshold values. The kit uses a competitive binding enzyme immunoassay to perform rapid interval testing for PCBs in soils and solution at specified action level of 1, 5, 10 and 50 parts per million. The test kit is standardized using Aroclor 1248, but it can also detect Aroclors 1016, 1242, 1254 and 1260. The presence of PCBs is detected by a photometer based on a colored reaction in which the color development is inversely proportional to the concentration of PCB in the sample (e.g., the darker the color, the less analyte PCB is present in the sample). The EnviroGard kit provides no information on Aroclor identification.

The demonstration found that the EnviroGard kit was simple to operate in the field, requiring about an hour for initial setup and preparation for sample analysis. The overall performance of the EnviroGard PCB test kit was characterized as biased and imprecise about 50% of the time; however, the kit generated no false positive or false negative results for soil samples. Dr. Gary Foley, Director of National Exposure Research Laboratory, Office of Research and Development, noted that there was increased likelihood that results would be biased high as a result of the false positive bias that the manufacturer has incorporated into the calculation of results.

RaPID Assay System for PCB Analysis:

The RaPID Assay System applies the principles of enzyme-linked immunosorbent assay to the determination of PCBs providing quantitative or semi-quantitative data. The sample to be

tested is added, along with an enzyme conjugate, to a disposable test tube, followed by paramagnetic particles coated with PCB-specific antibodies. The analyte PCB (which may be in the sample) and the labeled PCB compete for the antibody binding sites and bind in proportion to their original concentration. The presence of PCBs is detected by adding a colored reaction. Because the labeled PCB (enzyme conjugate) is in competition

with the analyte PCBs (in the sample) for the antibody sites, the color development is inversely proportional to the concentration of PCB in the sample (e.g., the darker the color, the less analyte PCB is present in the sample).

The demonstration found that the RaPID Assay system was light, easily transportable and rugged, requiring about one hour for initial setup and preparation for sample analysis. No site effects (i.e., differences in performance due to environmental conditions) were observed in terms of the accuracy of the measurements; however, the significant (but comparable to the best case precision of the reference laboratory) site effect for precision should be considered when using this technology. Overall, the performance of the RaPID Assay System was characterized as slightly biased and precise, under a given set of environmental conditions.

The Verification Statements for the D TECH, EnviroGard and RaPID Assay Systems report that the results of the demonstrations show that the kits can provide useful, cost-effective data for environmental problem-solving and decision-making. Undoubtedly, they will be employed in a variety of applications, ranging from serving as a complement to data generated in a fixed analytical laboratory to generating data that will stand alone in the decision making process.

SDI is a winner of EPA-New England's 2nd Annual Environmental Technology Innovator Award for its immunoassay-based test kits.



Field application of SDI immunoassay test kits.

For more information contact the corporate office:

Tim Lawruk
Strategic Diagnostic, Inc.
111 Pencader Drive
Newark, DE 19702
(302) 456-6789
(800) 544-8881
web: www.sdix.com
email: tlawruk@sdix.com

Or contact the New England representative:

Jacqueline Daitch
Strategic Diagnostic, Inc.
132 Great Road
Suite 200
Stowe, MA 01775
978-897-6125
email: jdaitch@sdix.com

ONSI GPU and PC25™ 200 kW Fuel Cell

For several years, ONSI Corporation, a subsidiary of United Technologies, has employed the commercially available phosphoric acid fuel cell (PC25™) to generate electricity from natural gas.

However, the fuel cell unit can also be used at municipal solid waste landfills to convert landfill gas into electric power. This application requires a supplemental gas treatment unit

(GPU) to remove sulfur and halide compounds present in the landfill gas (LFG). The GPU was designed and tested in cooperation with EPA's Office of Research and Development. The combined GPU and PC25™ Fuel Cell system provides a means for utilizing landfill gas, thus, reducing methane emissions and other air pollutants.

The design of the GPU is dictated by the gas purity requirements of the fuel cell, and the composition and physical properties of the incoming LFG. The cleaned waste gas is then converted into electric power for on-site use or distribution to an electric grid. In the GPU, hydrogen sulfide is first removed via adsorption on an activated carbon bed, which is used to catalyze the conversion of H₂S into elemental sulfur. Additional water, heavy hydrocarbons, sulfides and other contaminants are removed through the removal system consisting of a low temperature cooler, carbon bed, dryer bed, and particulate filter. A heat exchanger is used to ensure the gas temperature meets fuel cell inlet requirements.

The PC25™ fuel cell consists of a fuel processing system, an electrical conversion system, and a thermal management system. In the fuel processing section, treated LFG is converted to hydrogen

and carbon dioxide for introduction into the fuel cell stack. The fuel treatment process consists of a low temperature fuel preprocessor which removes the residual

contaminants from the treated gas, a fuel reformer and a low temperature shift converter where the exhaust from the reformer is further processed. The hydrogen from the process fuel stream is then combined electrochemi-

cally with oxygen from the air to produce electricity in the fuel cell stacks. The DC current produced is converted into AC in a power-conditioning package. The PC25™ is designed to produce 200 kW of electric power from natural gas. With LFG, the PC25™ unit generates less power due to the lower heating value of LFG.

Although the PC25™ 200 kW fuel cell system has been used on natural gas, the ETV was the first application on LFG with the new GPU system. Therefore, tests were conducted

to verify the performance of a combined GPU and PC25™ fuel cell system operating on LFG. These tests were conducted at the Penrose facility in Los Angeles, California and at the Groton Landfill in Connecticut where the LFG flow rates, composition, heating value and contaminant levels are representative of the U.S. landfill population.

The Verification Statement reports that the results of these tests satisfy the requirements set forth in the testing plan for the GPU and the fuel cell system. The GPU functioned according to its design

specification purifying LFG to a level, which was more suitable for fuel cell use. The fuel cell produced power with no forced outages and provided consistently low secondary emissions. Any outages were the result of gas supply issues. The electricity produced at both sites were connected to a local grid system and sold to utility companies.

The test verified that the cleanup system is capable of reducing total halogen and total sulfur levels to less than three ppmv, which are the minimum levels required to operate the fuel cell. The GPU flare met emission requirements for sulfur, volatile organic compounds and other hazardous pollutants and exceeded the minimum operating requirement. The overall cell efficiency was 37.1-38.0 percent and the adjusted availability of the cell was more than 96 percent at both sites.

John Trocciola of ONSI states, "ETV-verification has helped with getting an additional sale of another fuel cell at a landfill in Massachusetts." Under the sponsorship of EPA, a simplified version of the GPU was successfully tested at a wastewater treat-

ment facility in conjunction with a PC-25. This successful test resulted in the sale and installation of four additional PC-25s at wastewater treatment facilities in the U.S.

"ETV-verification has helped with getting an additional sale of another fuel cell at a landfill in Massachusetts."

John Trocciola
ONSI Corporation

For more information:

John Trocciola
ONSI Corporation
195 Governors Highway
South Windsor, CT 06074
860-727-2388

Perkin - Elmer Voyager

The Voyager is a field-portable gas chromatograph (GC) and is the fourth generation in the evolutionary design of field-portable GCs from the Photovac division of Perkin-Elmer. Gas chromatography with photo ionization detection and electron capture detection is a proven analytical technology that has been used in environmental laboratories for many years. The gas chromatographic column separates the sample into individual components. Compounds are identified by matching column retention time of sample components run under controlled temperature conditions to those of standard mixtures run under similar conditions. Quantification is achieved by comparing the detector response intensity of the sample component with the standard.

A portable GC is a versatile technique that can be used to provide rapid screening data or routine monitoring of groundwater samples. In many GC systems, the instrument configuration can

be quickly changed to accommodate different sample matrices such as soil, soil gas, water or air. As with all field analytical studies, it may be necessary to send a portion of the samples to an independent laboratory for confirmatory analyses.

The Voyager includes an on-board processor and is encapsulated in a weather-resistant case. The instrument incorporates three columns and dual detectors to achieve broadened analytical capabilities, a high-sensitivity photoionization detector, and a miniature electron capture detector. The GC unit weighs about 15 pounds. The units can be easily transported, and operated in the rear compartment of a minivan. The instrument utilizes an equilibrium headspace technique for the analysis of volatile organic compounds (VOCs) in water. Sample processing and analysis can be accomplished by a chemical technician with one day training; however, instrument method development and initial calibration may require additional experience and training.

The field demonstration of the Voyager portable GC was held in September 1997. The demonstration was designed to assess the instrument's ability to detect and measure chlorinated VOCs in groundwater at two contaminated sites: the Department of Energy's Savannah River Site and the McClellan Air Force Base. Groundwater samples for each site were supplemented with performance evaluation samples of known composition.

The sample throughput was one to three samples per hour. This rate includes

the periodic analysis of blanks and calibration check samples. The results of the demonstration revealed that sample handling methodologies

may have adversely affected the observed precision and accuracy of the instrument. Perkin-Elmer Photovac has developed an improved field method for sample preparation and handling that includes the use of an internal standard. The new method is expected to improve instrument precision

and accuracy. The Verification Statement states that the Voyager may be suitable for both field screening and routine analysis applications.

According to Peter Ebersold of Perkin-Elmer Photovac, the ETV Program has brought credibility to the technology in the eyes of regulators. He states, "Field technology has long been accepted as a screening tool, but only recently has it begun to be accepted as a replacement for lab analysis. Our participation in the ETV Program has provided verification of the Voyager's specifications and helped speed up acceptance of the Voyager Portable GC for field quantification of VOCs." In addition, he says, "The publicity surrounding the ETV program has proven to be an effective tool for bringing attention to our product."

"Our participation in the ETV Program has provided verification of the Voyager's specifications and helped speed up acceptance of the Voyager Portable GC for field quantification of VOCs."

Peter Ebersold
Perkin-Elmer Photovac



*Perkin-Elmer's
Field-portable Voyager*

For more information:

Peter Ebersold
Perkin-Elmer Photovac
50 Danbury Road
Wilton, CT 06897
203-761-2616

NEWMOA Technology Review Committee

Several groups in New England recognized the need for a regional effort to overcome regulatory and institutional barriers to the acceptance of innovative technologies, which have the potential to cleanup and protect the environment and public's health in a more cost-effective and efficient manner. As a result, in March 1998, the six New England States, EPA Region I - New England, the Northeast Waste Management Officials' Association (NEWMOA) and the New England Governors' Conference signed a Memorandum of Agreement (MOA) to promote interstate regulatory cooperation for waste site assessment and cleanup technologies.

NEWMOA subsequently established a Technology Review Committee (TRC) to address the lack of an interstate forum in the Northeast to actively review technologies and communicate both private and public sector use of innovative technologies. The TRC is made up of one or more staff members from each of the New England states and New York who coordinate state review, issue advisory opinions and disseminate information on the use of innovative technologies. The TRC has issued advisory opinions on Immunoassay Field Analysis and X-Ray Fluorescence Field Analysis. The advisory opinions can be viewed in their entirety on CEIT's web page (<http://www.epa.gov/region01/steward/ceit>) and NEWMOA's web page (<http://www.newmoa.org>).

Overview of the Advisory Opinion on Immunoassay Field Analysis

On May 24, 1999, the TRC issued an advisory opinion on Immunoassay Field Analysis. Immunoassay test kits have been developed to be specific to individual compounds or compound groups. Some kits are designed to yield qualitative results (e.g. the contaminant is or is not present), some provide semi-quantitative results (e.g. the contaminant is above, below or between two specified levels) and others produce quantitative

results with low detection limits. Combined with simple field sample preparation techniques, immunoassay technology can be used to analyze many different types of environmental matrices, including water, soil, surface (wipes), sediment, sludge, compost and concrete.

As an overview, the Advisory Opinion states that the primary advantage of immunoassay analysis is that analytical results can be generated in real-time. This allows decision-making in the field regarding the need for additional sampling or further remediation (provided that proper data validation procedures are followed). It strongly urges potential users of immunoassay to consult U.S. EPA Region I's *Immunoassay Guidelines for Planning Environmental Projects* (October 1996) and with kit vendors prior to planning the field effort. The guidelines can be obtained at <http://www.epa.gov/region01/measure/ia/iaguide.html> or by calling 617-918-1783. Immunoassay technology has been used for site characterization or cleanup monitoring at over 40 Superfund sites, including several Department of Defense (DOD) and Department of Energy (DOE) facilities. In addition, several Northeast states have successfully used immunoassay technology during site characterization and/or remediation, including Maine, Massachusetts, New York, Rhode Island, and Vermont. The New York State Department of Environmental Conservation's Division of Environmental Remediation has issued *Quality Assurance Guidelines for Using Immunoassay Field Screening*, which can be obtained by calling 518-457-9280. The Advisory Opinion also includes 10 recommendations for improving or insuring product performance.

Overview of the Advisory Opinion on X-Ray Fluorescence Field Analysis

On September 21, 1999, the TRC issued an advisory opinion on X-Ray Fluorescence Field (XRF) Analysis. XRF is a nondestructive analytical technique

used to determine the metals composition of samples, primarily soils. XRF can also be used to determine the metals concentration in water or air. The primary advantage of XRF analysis over laboratory analysis is that analytical results can be generated in real-time which allows decision-making in the field regarding the need for additional sampling or further remediation (provided that proper data validation procedures are followed). Another advantage of XRF analysis over standard laboratory analysis is that the procedure does not involve altering the soil sample (other than mixing and possibly grinding) so no investigation derived wastes are generated as they are when extraction with solvent or acid is performed.

XRF technology has been used for site characterization or cleanup monitoring at more than 35 Superfund sites, including several Department of Defense (DOD) and Department of Energy (DOE) facilities. U.S. EPA Region I has used XRF technology at several sites in New England and has published *Standard Operating Procedure for Elemental Analysis Using the X-MET 920 Field X-Ray Fluorescence Analyzer* in October 1996. The guidelines can be obtained at <http://www.epa.gov/region01/measure/xray/xrayfluor.html> or by calling 617-918-1783. In addition, several Northeast states have successfully used XRF technology during site characterization and/or remediation, including Massachusetts, New Hampshire, New York and Vermont. Potential users of XRF technology are strongly urged to consult U.S. EPA Region I's standard operating procedure and technology vendors *prior* to planning the field effort. The Advisory Opinion provides six recommendations for improving or insuring product performance.

See box at right for more information on NEWMOA Technology Review Committee.

The Massachusetts Strategic Environmental Partnership

Recognizing the importance of its environmental industry, Massachusetts launched the Strategic Environmental Partnership (STEP), a unique collaborative effort between the Executive Office of Environmental Affairs (EOEA) and the University of Massachusetts (UMass) System. Through the STEP initiative, EOEA and UMass work together as partners to facilitate the development and use of innovative environmental and energy-efficient technologies. STEP offers a broad array of services:

Business Support

The STEP Program helps emerging companies refine their business plans, target niche markets for their products, and identify potential sources of financing.

Regulatory and Permitting Assistance

Through regulatory reviews, STEP agencies help entrepreneurs identify

the regulations that apply to their new technologies and to their potential customers' businesses. In addition, the Massachusetts Department of Environmental Protection provides expedited reviews of permit applications to help STEP technologies reach the marketplace sooner.

Technology Assessment

STEP's business and technology assessments are designed to verify cost, performance, and potential markets, and to evaluate the company's management and business model.

Technology Demonstration

STEP provides opportunities to demonstrate, evaluate and improve the capabilities of technologies at state-owned properties.

Technology Transfer

The STEP program is committed to promoting the acceptance of innovative environmental technologies in

other states and in the global marketplace. Toward this end, Massachusetts and five other states – California, Illinois, New Jersey, New York and Pennsylvania – established the Six State Partnership for Environmental Technology.

For more information:

Jenny Braun-Friedman
STEP Associate
617-626-1052
jenny.braun-
friedman@state.ma.us

For more information on the NEWMOA Technology Review Committee:

In Connecticut:

Christine Lacas
Department of Environmental
Protection
860-424-3766

In Maine:

Mark Hyland
Department of Environmental
Protection
207-287-7673

In Massachusetts:

Dorothy Allen
Department of Environmental
Protection
617-292-5795

In New Hampshire:

Robert Minicucci
Department of Environmental Services
603-271-2941

In New York:

James Harrington
Department of Environmental
Conservation
518-457-0337

In Rhode Island:

Laurie Grandchamp or Paul Kulpa
Department of Environmental
Management
401-222-2797

In Vermont:

Richard Spiese
Department of Environmental
Conservation
802-241-3888

At NEWMOA:

Jennifer Griffith
NEWMOA
617-367-8558, ext. 303

At EPA Region I:

Carol Kilbride
U.S. EPA
617-918-1831
or 1-800-575-CEIT (2348)

| Overview of Programs | | |
|---|---|--|
| ETV Program | NEWMOA Technology Review Committee | Massachusetts STEP Program |
| Focuses on technologies in the 12 verification pilot programs | Focuses on technologies in specific areas covered under an Interstate Memorandum of Understanding | Focuses primarily on technologies developed by Massachusetts companies |
| Focuses only on commercial-ready technologies | Focuses only on commercial-ready technologies | Focuses on technologies in all stages of development |
| Provides independent testing of technology performance | Evaluates submitted performance data | Provides testing opportunities and introduces companies to clients who may host demonstrations |
| Verifies technology performance | Assesses the technology's applicability, operating parameters, maintenance requirements and limitations | Verifies technology cost, performance and potential markets |
| Issues Verification Statement (overview) and Verification Report (include testing protocol and results) | Issues Advisory Opinion | Issues Technology Assessment |
| Also: Features Verification Statement and Verification Report on the Internet | Also: Shares state-specific information | Also: Provides business support, regulatory and permitting assistance, and opportunity to demonstrate projects at state facilities |

About CEIT

EPA's Center for Environmental Industry and Technology (CEIT) is moving forward with our mission to promote New England's environmental technologies. We have embarked on numerous programs and projects designed to sustain the strength of the environmental industry, make it easier to commercialize new technologies, provide more flexibility for environmental technologies buyers and reduce costs for the regulated community. The CEIT acts as a point of contact for the environmental industry, technology developers, investors and other interested stakeholders, providing an ombudsman service for those seeking assistance on the development of new technologies.

The following are highlights of our services:

Golden Opportunity Series

Through this series, participants learn about technology transfer; assistance and verification opportunities; and, financing opportunities.

Technology Trade Shows

Technology Trade Shows showcase new and innovative technologies. Trade shows for 2000 are focused on erosion and sediment control technologies and ETV-verified monitoring technologies.

Technovation

CEIT's technical bulletin highlights promising technologies developed by New England companies.

Ombudsman Hotline

The CEIT offers assistance, information, and referrals on a wide range of federal and state programs to the in-

dustry through its Ombudsman Hotline: 1-800-575-CEIT.

CEIT HomePage

A visit to our Home page at www.epa.gov/region01/steward/ceit will give you up-to-date information on business opportunities, upcoming events, and links to other websites of interest to the envirotech industry.

EnvirotechNews

CEIT's monthly listserve, Envirotech News, contains information on upcoming events, business opportunities and technology opportunities.

If you would like to know more about CEIT services or events, please call 1-800-575-CEIT (2348) or 617-918-1783.

Environmental Technology Verification Program Pilot Managers

ETV Program Coordination

Penelope Hansen,
Tina Maragousis Conley, Sarah
Bauer—Environmental
Protection Agency (EPA)
202-564-3211

Drinking Water Systems

Jeff Adams, EPA
513-569-7835

Bruce Bartley, National Science
Foundation (NSF)
1-800-673-6275

Site Characterization and Monitoring Technologies

Eric Koglin, EPA
702-798-2432

Roger Jenkins, Oak Ridge
423-576-8594

Wayne Einfeld, Sandia National
Laboratories (SNL)
505-845-8314

Pollution Prevention (P2), Recycling and Waste Treatment Systems

Norma Lewis, EPA
513-569-7665

Tony Luan, California EPA 916-
322-3670

P2 Innovative Coatings and Coating Equipment

Michael Kosusko, EPA
919-541-2734

Brian Schweitzer, Concurrent
Technologies Corp. (CTC)
814-269-2772

Indoor Air Products

Les Sparks, EPA
919-541-2458

David Ensor, Research Triangle
Institute (RTI)
919-541-6735

EvTEC

Norma Lewis, EPA
513-569-7665

William Kirksey, Civil
Engineering Research
Foundation (CERF)
202-842-0555

Source Water Protection Technologies

Ray Frederick, EPA
732-321-6627
Tom Stevens, NSF
734-769-5347

Greenhouse Gas Technology

Dave Kirchgessner, EPA
919-541-4021

Stephen Piccot, Southern
Research Institute (SRI)
919-403-0282

P2 Metal Finishing Technologies

Alva Edwards Daniels, EPA
513-569-7693

Jim Voytko, CTC
727-549-7006

Advanced Monitoring Systems

Robert Fuerst, EPA
919-541-2220

Karen Riggs, Battelle
614-424-7379

Air Pollution Control Technology

Ted Brna, EPA
919-541-2683

Jack Farmer, RTI
919-541-6909

Wet Weather Flow Technologies

Mary Stinson, EPA
732-321-6683

John Schenk, NSF
734-913-5719

For additional information, visit our Web site at <http://www.epa.gov/region01/steward/ceit/>



EPA New England
1 Congress Street Suite 1100 (SPI)
Boston, MA 02114-2023

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